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SENSOR BASED FAULT IDENTIFICATION AND PROTECTION OF INDUCTION MOTOR

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ABSTRACT

Protection of an induction motor (IM) against possible problems, such as overvoltage, over current, overload, over temperature, and under voltage, occurring in the course of its operation is very important, because it is used intensively in industry as an actuator. IMs can be protected using some components, such as timers, contactors, voltage, and current relays. the voltages, the currents, the speed, and the temperature values of the motor, and the problems occurred in the system, are monitored and warning messages are shown on the computer screen. This paper focuses on experimental results to identify and protect faults in 3-phaseinduction motors using LabVIEW.

KEYWORDS: fault identification, protection, induction motor.

1. INTRODUCTION:

Induction motors (IMs) are used as ac-tuators in many industrial processes. Although IMs are reliable, they are subjected to some undesirable stresses, causing faults resulting in failure. Monitoring of an IM is a fast emerging technology for the detection of initial faults. It avoids unexpected failure of an industrial process. Monitoring techniques can be classified as the conventional and the digital techniques. Classical monitoring techniques for three-phase IMs are generally provided by some combina-tion of mechanical and electrical monitoring equipment.

Mechanical forms of motor sensing are also limited in ability to detect electrical faults, such as stator insulation failures. In addition, the mechanical parts of the equipment can cause problems in the course of operation and can reduce the life and efficiency of a system.

In study, a computer based protection system has been introduced. Measurements of the voltages, currents, temperatures, and speed were achieved and transferred to the computer for final protection decision.

2. EXISTING TECHNIQUES:

A. Siddique,2005[1]- This work presents a comprehensive review of various stator faults, their causes, detection parameters/techniques, and latest trends in the condition monitoring technology. It is aimed at providing a broad perspective on the status of stator fault moni-toring to researchers and application engineers using induction motors.

M. G. Ioannides,2004[2]- The implementation of a monitoring and control system for the in-duction motor based on programmable logic controller (PLC) technology is described. Also, the implementation of the hardware and soft-ware for speed control and protection with the results obtained from tests on induction motor performance is provided. The PLC correlates the operational parameters to the speed re-quested by the user and monitors the system during normal operation and under trip condi-tions.

A. R. Al-Ali,2002[3]- The features of these techniques and the improvements that they in-troduce in the diagnostic process are recalled, showing that, in order to obtain indication on the fault extent, faulty machine models are still essential. The models must trade off between simulation result effectiveness and simplicity. With reference to rotor electrical faults of in-duction machines, a new and simple model which includes the speed ripple effect is devel-oped.

M. E. H. Benbouzid[4]- This paper provides a comprehensive list of books, workshops, con-ferences, and journal papers related to induc-tion motors faults detection and diagnosis.

3. PROBLEM DEFINING:

Condition monitoring and fault diagnosis of induction motors are of great importance in production lines. It can significantly reduce the cost of maintenance and the risk of unexpected failures by allowing the early detection of potentially catastrophic faults. Incondition based maintenance, one does not schedule maintenance or machine replacementbased on previous records or statistical estimates of machine failure. Rather, one relies on theinformation provided by condition monitoring systems assessing the machine's condition.Thus the key for the success of condition based maintenance is having an accurate means ofcondition assessment and fault diagnosis. On-line condition monitoring uses measurementstaken while a machine is in operating condition. There are around 1.2 billion of electric motors used in the United States, which consume about 57% of the generated electric power. Over 70% of the electrical energy used by manufacturing and 90% in process industries are consumed by motor driven systems.Among these motor systems, squirrel-cage induction motors (SCIM) have a dominant percentage because they are robust, easily installed, controlled, and adaptable for manyindustrial applications. SCIM find applications in pumps, fans, air compressors, machinetools, mixers, and conveyor belts, as well as many other industrial applications. Moreover,induction motors may be supplied directly from a constant frequency sinusoidal power supplyor by an a.c. variable frequency drive. Thus condition based maintenance is essential for aninduction motor.

4. OBJECTIVES:

The main aim of the research work is to diagnose the common electrical faults and pro-tect it.

LABVIEW software is used to detect the faults with direct online monitoring.

To perform accurate and reliable analysis on induction motors, the installation of motors and measurement of their signal need to be reli-able.

5. OUR CONTRIBUATION:

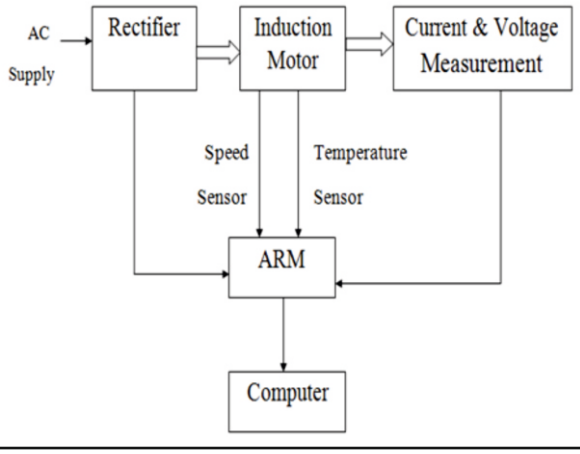
As seen in all above research paper, they are using PLC IM fault detection and pro-tection. There is also conversion of 3-phase ac supply into +5 Vdc supply takes place. As PLC works on +5V dc.

As PLC works on Ladder diagram .Basic ladder diagram is depend on each other. Therefore cost of PLC is more as compare to microcontroller .

In microcontroller complexity of cir-cuitry is less. In microcontroller dependency of design making is takes place very fast. So for more reliability, we here design a new protec-tion system can be applied to different ac mo-tors. This system eliminates the conversion card.

Here we are detection of faults like over voltage, over current, over temperature using sensors. Labview comes on Linux now, which eliminates the hangs and crashes. Labview is especially suited for test applications and in-strumentation.

6. BLOCK DIAGRAM:



DESCRIPTION OF BLOCK DIAGRAM:

Temperature Sensor-Temperature sen-sors, whose output voltage is linearly propor-tional to the Celsius (Centigrade) temperature.

Voltage Protection System- In voltage meas-urement we get two faults first is over-voltage and second is under voltage. Over voltage is voltage greater than limit voltage and under voltage is voltage lees than limit voltage. When supply voltage is greater than 250 volt we get over-voltage fault then with help of con-troller we stop the motor and we control the over-voltage. Also if we get supply voltage is less than 150 volt, we get under voltage fault then we stop the motor and control the under-voltage, by using PIC microcontroller pro-gramming we increases and decreases duty cy-cle of PWM inverter when voltage is varying between 250volt to 150volt. Here we can in-crease or decrease the voltage of induction mo-tor by using dimmer.

Current Protection Circuit- A current transformer (CT) is used for measure-ment of electric current when current is too high to di-rectly apply to measuring instrument, to the current incircuit, which can be conveniently connected to mea-suring and recording instru-ments. A Current Transformer also isolates them ensuring instruments from what may be very high voltage in the monitored cir-cuit. CT is commonly used in metering and protective relays in the electrical power industry. The phase current is measured for detecting the fault of over- cur-rent. We design measurement circuit with current transformer. It step down the current to low level. The current is then converted into voltage using current to voltage transformer and rectified to get the output voltage.

Speed Sensor- In our project we put that sensor in front of motor fan, which count motor revolution. Actual speed of induction motor is 1400rpm. 1400rpm is dividing by 60 and we get center point of pulses are 25. This point is given to con-troller, when motor start running if pulses are greater than 25 pulse motor mini-mize the speed and if less the 25 it increase the speed. Finally motor try to achieve center point that is 25.

6. CONCLUSION

1. The design aims are detecting the faults then monitoring and controlling the motor from these faults.

2. First find out tolerable limit values of voltage, current, speed, temperature. Then these parameters are measured and are com-pared to these tolerable limit value. The three phase inverter is used to convert DC voltage obtained from rectifier into AC .

3. When parameters are out of range by using ARM we protect the motor from faults. Here we use CT for current measurement. LM35 for temperature mea-surement and IR sensor for speed measurement.

4. The protection system used in this study consists of a three-phase IM, volt-age transformers current transformers, a tempera-ture sensor and an incre-mental encoder used for measuring the rotor speed, a true rms to dc conver-sion card, microcontroller.

7. REFERENCES:

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